PATENT
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METHOD AND APPARATUS FOR TRANSMITTING DATA BETWEEN DEVICES IN A WEB NETWORKING ENVIRONMENT

Related Application(s):

This Patent Application claims priority under 35 U.S.C. 119 (e) of the co-pending U.S. Provisional Patent Application, Serial No. 60/221,818, filed July 31, 2000, and entitled "METHOD AND APPARATUS FOR TRANSMITTING DATA BETWEEN DEVICES IN A WEB NETWORKING ENVIRONMENT". The Provisional Patent Application, Serial No. 60/221,818, filed July 31, 2000, and entitled "METHOD AND APPARATUS FOR TRANSMITTING DATA BETWEEN DEVICES IN A WEB NETWORKING ENVIRONMENT" is also hereby incorporated by reference.

Field of the Invention:

The present invention relates to an architecture, a system for and a method of transferring data between web devices in a web network environment and the general internet population. More specifically, this invention relates to an efficient, adaptable and scalable architecture, system for and method of transferring data between web devices in a web network environment and the general internet population.

Background of the Invention:

The internet provides a general public transport medium to support several user protocols such as e-mail, FTP and HTTP. With the internet, computers can share information throughout the world and in space being only limited by the ability to establish a point of connection with the internet. The internet provides reliable,

inexpensive, high speed data transmissions for transacting business in business-to-consumer or business-to-business relationships world wide. Because of the flexibility and the ease with which information is transmitted over the internet, e-commerce and the internet is changing the fundamental way that business is conducted.

Using a personal computer, and the appropriate user protocols, customers log into web sites and accesses web pages or HTML files that are hosted at remote web servers. Web server devices are usually individual machines that support each of the internet protocols that in turn provide the data to consumers through their personal computers. The customers can access and receive information about a business or an organization, interact with the web pages or HTML files and provide customer information to the organization or business.

The systems hardware and software that drives and supports a web site after it is physical connected to the internet is referred to, herein, as a web support system. Typically, each web support system is tailored to suit the particular needs of the organization or business. For example, a web support system which receives and collects tax information requires the ability retrieve and store large amounts of data. Such a system will be data base and data storage intensive and will, therefore, typically have several data base/storage components or devices. On the other hand, a web support systems which provides customers with interactive games to promote products is application intensive and will typically require several application components or devices. Regardless of the particular needs of the organization or business, each web support system is custom designed and custom built, with each of the system components or devices being wired to a system bus and individually programmed.

Summary of the Invention:

According to the current invention, a web support system is constructed by providing a pre-configured, layered design that interconnects individual system components in a predetermined position relative to one another and provides at least a portion of the system bus for the transmission of data between the components. The pre-positioning of components is customized to meet the needs of a business or organization, but may also be standardized to meet several application needs. The layered design is preferably configured to be versatile enough to provide the connectivities for components within a systems having a variety of system complexities and configurations. For example, the layered design is configured with dormant or spare positions that allow for the integration of additional components or devices into the system as the needs of the business or organization change, expand or evolve. The layered design preferably provides positions for a plurality of web servers, a file server, a data base device, and at least one application server.

The system of the current invention provides for the ability to program each of the system components with personalities required to perform their particular function based on their respective positioning to a pre-built harness. In accordance with the invention, the file server is programmed with knowledge of the layered design, system architecture and component positioning on the wire harness and stores the configuration files required to program each of the system components. The file server auto-programs and auto-updates each of the components according to their individual function and relative positioning to one another on the pre-configured wire harness. In the event that one of the system components needs to be replaced due to a malfunction, the file server will automatically program the new replacement component to perform the function of the

replaced component. This can greatly reduce the cost of maintenance for the web support system because an organization or a business can simply unplug the defective component from the wire harness and replace it with a new component without calling a technician to install and program the replacement component.

The pre-configured wire harness has several other advantages including reducing or eliminating confusing agglomerations of wires typically associated with web support systems and provides a simple and efficient way to duplicate a preexisting web support system. For example, in the event that a business or an organization wants to relocate the physical location of their web support system, then a duplicate pre-configured harness is provided along with a duplicate file server device containing duplicate configuration files for each of the components in the master web support system. The auto-programming features of the file server device, along with its knowledge of the system architecture allows each of the new components in the duplicate system to be auto-configured and duplicate the functionality of corresponding components in the master system. Thus, a business or an organization never needs to shut down, stop traffic or reduce traffic to their web site while construction of a new system is underway.

According to the preferred method of the instant invention, the configuration files that are used to program each of the system components with their appropriate personalities are down loaded to the file server from a remote location. Thus, with the installation of an entirely new web support system, the components of the new system are first connected to the bus through the pre-configured wire harness. The configuration files are then down-loaded to the file server from the remote location. Then the file server auto programs all of the other system components with their respective personalities. The entire system is then initialized to support the web site without

requiring any of the individual components be programmed by an on-site technician. Further, by remote downloading of the configuration files and system shared software to the file server, the system is continuously updated from the remote location with new and improved configuration files and software. In this way, the file server provides the auto-programming intelligence link for each of the individual components within the system. Preferably, after the system is initialized each component periodically queries the file server to initiate the installation or updated configuration files, programs, software or files.

According to an alternative embodiment of the invention, the pre-configured wire harness is configured with a switching means to switch the connectivities between system components. Preferably, the switching means is provided to switch the connectivities between a web server and an application server. In the event that a critical server malfunctions, the server can be switched out and effectively replaced with a functioning and less critical server that is already available within the system. After switching the defective server with the replacement server, the replacement server is auto-programmed to operate according to its new function. Because web support systems are typically provided with duplicate servers of each type, switching out of a server device, as described above, does not leave the web support system void of any particular functionality, but rather effectively ensures that critical functions of the system are always duplicated and, therefore, reduces the possibility of a critical systems failure.

As a further improvement over currently available web support systems, the architecture of the current invention preferably provides for at least two transmission pathways between the web support system and the internet. One of the pathways is a non-restrictive transmission pathway between the web support system and the internet

and the second data transmission pathway includes a fire wall device between the web support system and the internet. According to current invention, the system discerns between nonsensitive data and sensitive data. The nonsensitive data is transmitted between the internet and the web support system through the non-restrictive data transmission pathway and the sensitive data is transmitted through the data transmission pathway that includes a fire wall device between the web support system and the internet. The web architecture of the instant invention, provides for discretionary data transmissions between the internet and the web support systems at the system level and provides for the ability to transmit high volume data between the internet and the web support system more efficiently.

In yet another embodiment of the present invention, the web support system includes a central control unit. The central control unit is in connected to individual system components or devices. This central control unit can co-exist on the file server to provide multiple functionality within the web support system. The central control unit monitors the physical condition of each of the connected components or devices. Preferably, the central control unit collects and stores data regarding the physical condition of each of the connected components over time. For example, the control unit monitors each system component for temperature variability. In the event that one of the components malfunctions, the data can be analyzed to discern if the cause of the malfunction was related to a fluctuation in temperature. The central control unit is also configured to have alert function. In the event that the functionality of a component or device within the system is in jeopardy, either due to an unauthorized intrusive action or because of changes in environmental conditions, an alarm is initiated on site or at a remote location.

Brief Description of the Drawings:

Figure 1 illustrates a prior art two-tier web support system architecture.

Figure 2 illustrates a prior art three-tier web support system architecture.

Figure 3 illustrates three-tier web support system architecture, in accordance with the current invention.

Figure 4 illustrates a block flow diagram for building the web support system, in accordance with the current invention.

Figure 5 illustrates a block flow diagram for exchanging or replacing a server device within the web support system, in accordance with the current invention..

Figure 6 illustrates schematic of a three-tier web support system architecture with a switching harness for exchanging connectivities of servers within the system.

Figure 7 illustrates three-tier web support system architecture with a network switch to be managed by a central control management function, in accordance with an embodiment of the current invention.

Detailed Description of a Preferred Embodiment:

Figure 1 illustrates a two-tier web-bases system **100** according to a prior art design. The architecture has a web interface tier **150** and an application/data base tier **151**. The web or the internet **101** is connected to the system **100** through a router device or a firewall device **102**. The router device **102** provides for data transmission security over the entire system. The router device **102** reads each data packet, or a portion thereof, before it is transmitted between the web **101** and the system **100**. The router **102** checks for the proper authorization code or an authorized address and only allows those data

packets with a proper authorization code or address to pass between the web **101** and the system **100**.

The web servers units **104**, **105**, and **106** are continuously connected to the web **101** and contain web pages or HTML files that are be viewed from a browser program on a remote computer device (not shown). Between the router **102** and the web servers **104**, **105**, and **106**, there is a load balancer **103** which coordinates data transfers or directs traffic between customers accessing web pages or HTML files on the individual web servers **104**, **105**, and **106**.

Still referring to the Figure 1, within the application/data base tier **151** there is a file server **107** and at least one application/data base device **108**. The file server **107** stores software that is shared between each component of the system **100**; in particular the software shared between the application/data base **108** and the web servers **104**, **105**, and **106**. The file server **107** shares software with the other system components over a system bus **110** or a local area network (LAN) which provides the physical point-to-point connections between each system components. The application/data base device **108** provides the system **100** with raw computing power and storage capacity for storing the data required to achieve the intended results of the system **100**.

Figure 2 illustrates a three-tier web-based system **200** according to a prior art design. The web interface tier **250** of the system **200** is identical, or similar, to the web interface tier **150** that is shown in the Figure 1. The web or the internet **201** is connected to the system **200** through a router device or a firewall device **202**. The router device **202** provides the same security functionality as that of the router device **101** that is shown in the Figure 1 and described above; namely, the device **201** prevents the transmission of unauthorized data between the web **201** and the system **200**.

The web servers **204**, **205**, and **206** are again continuously connected to the web **201** and contain web pages or HTML files that can be viewed from a browser on a remote computer device (not shown). As with the web system **100** illustrated in the Figure 1, the system **200** has a load balancer **203** positioned between the router **202** and the web servers **204**, **205**, and **206**, which coordinates data transfers or directs traffic between customers accessing web pages or HTML files at the individual web servers **204**, **205**, and **206**.

Still referring to the Figure 2, the three-tier system **200** has an application tier **251** with application servers **208** and **209**. The application tier **251** is configured with any number of application servers suitable for the intended purpose. The system **200** also has a data base tier **252** with at least one data base device **210** which can be configured with any number of data base devices suitable for the intended use of the system **200**.

Regardless of whether a web support system has the two-tier architecture, as shown in the Figure 1, or the three-tier architecture, as shown in the Figure 2, the ability of such systems to support high volumes of data transmissions is limited by the ability of the router device or fire wall device to process, to decode and authorize the data transmissions between the servers and the web. The architecture of the current invention seeks to reduce the restriction of data flow between the web support system and the web by providing at least one additional data transmission route between the support system and the web.

Figure 3 illustrates a three-tier system architecture **300** according to the preferred embodiment of the current invention. It will be clear from the ensuing description, that architecture described is also compatible with a two-tier architecture or any other number of system architectures that are known in the art. The architecture **300** has web interface

tier **350** with web servers **304** and **305**. The web interface tier **350** is connected to the web **301** at the systems level through a bus **327** having an in-line router device or a firewall device **302** for providing a restricted data transmission pathway **325** between the system **300** and the web **301**. The restricted data transmission pathway **325** is used for transmitting potentially sensitive data between the system **300** and the web **301**. The system **300** is also connected to the internet **301** by a non-restricted transmission pathway **326**. The non-restricted pathway **326** is for transmitting non-sensitive data between the system **300** and the web **301**. Preferably, the system **300** has a load balancer **303** which coordinates data transmissions or directs traffic between customers accessing web pages or HTML files stored on the web servers **304-305**.

Still referring to Figure 3, the system **300** also has an application tier **351** with application servers **307-308** and a file server **306**. The data base tier has data base devices **309-310** which provide the data storage and data management required for the system **300**. The system **300** that is illustrated in the Figure 3, is intended to be exemplary only. The "multi-path data transmission architecture" (MPDTA) of the current invention can be practiced with web support systems configured for any number of web servers, application servers and data base devices.

Still referring to Figure 3, the system **300** preferably determines whether or not data is potentially sensitive at the systems level. If the data is determined to be potentially sensitive, the system **300** routes the data over the bus **327** through the data transmission path **325** and through the router device **302**. If the system **300** determines that the data is non-sensitive, then the system **300** routes data over the bus **327** through the non-restricted data path **326**.

By providing discretionary data transmissions at the systems level, the amount of data that is required to be transmitted through the router **302** is greatly reduced and the system **300** is capable of supporting higher volumes of data transmission than a similar system with a single data transmission pathway between the system and the web **301**. As a result of the increase system efficiency provided by the multi-path data transmissions architecture of the instant invention, the system **300** can support additional components integrated into the system in the direction **312** without requiring an additional router device or without splitting the devices between multiple web addresses.

Web support systems, such as those described above, are typically custom wired, custom installed and each of the system components, including the web servers and the application servers, are individually programmed by an "on site" technician. This process is both costly and time consuming. Further, web support systems that are constructed by this method result in agglomerations of wires connecting the system components. The wiring is both difficult to maintain and difficult to repair in the event of a malfunction. Thus the system **300**, is preferably provided with a pre-configured wire harness (not shown) that is designed to provide the connectivities for each of the system components including the web servers **304-305**, the application servers **307-308**, the file server **306**, and the data base devices **309-310**. The pre-configured wire harness provides a map for the system connections of each of the components **304-310**. The pre-configured wire harness also provides for at least of portion of the network bus **327** through which data is shared between the components **304-310** and transmitted between the system **300** and the web **301**. The pre-configured wire harness of the current invention reduces the amount of wiring required to connect the components, provides a standard for interconnecting each

component **304-310** of the system **300** and allows the connections between components **304-310** of the system **300** to be readily traced and repaired in the event of a malfunction.

Figure 4 illustrates a block flow diagram **400** for constructing a web support system according to the method of the current invention. In the step **401**, the system needs are determined. System needs include the number/type of web servers, the number/type of application servers, and the number/type of data base devices that are needed to support the web site. After the systems needs are determined in the step **401**, then in the step **402** a wire harness is configured to support the components and to provide the connectivities for all of the components. The wiring harness is preferably installed into a rack which provides the physical support for some, or all, of the system components. The support rack, the wire harness and the components are then either sent to the preferred installation location where they are assembled in the step **403**. Alternatively, the components are assembled in step **403** and then sent to the preferred installation location. The step **403** of assembling the system is accomplished by connecting each of the components to their respective predetermined connectivities within the pre-configured wire harness and by providing a connection to the web.

In the step **404**, configuration files are down-loaded to the file server. The configuration files are then used in the step **405** to program each of the system components with a functional personality that is required for the device to perform an assigned function, as determined in the step **401**. The step **404** of downloading the configuration files is preferably accomplished by down-loading the configuration files to the file server after the assembly step **403**. However, it is considered to be within the scope of the invention that the configuration files are down-loaded to the file server prior to the assembly of the system in the step **403**.

In the step **405**, the file server programs each of the system components with the appropriate configuration file. The file server determines which configuration file is appropriate for each component based on programmed knowledge of the connectivities of the component to the pre-configured wire harness, by the serial number code of each component, a logical address on the system bus or a combination thereof. The installation of the configuration files or the programming of each of the system components in the step **405**, is initiated either by the file server or by the components themselves. Preferably, after the components are configured in the step **405**, then in the step **406** the system is initialized and tested to ensure that the system and all of the individual components are functioning properly. If it is determined that there is a malfunction or that all the proper connections have not been made in the step **407**, then in the step **408** the malfunctioning component or components are replaced and the steps **406-408** are repeated until all the critical components are operating properly. If it is determined that all the critical components are operating and that all the appropriate connections are made in the step **407**, then in the step **409** the file server periodically updates and reconfigures each of the components to ensure the components have appropriate and updated functionalities.

According to the preferred embodiment of the invention, the file server is periodically updated with new configuration files and software from a remote location and the updated configuration files and software are then used to periodically update each of the system components. In this way the file server provide an "intelligence link" to each of the components from a remote location. An update of a component is preferably initiated at the request of the component. Accordingly, each of the system component periodically requests the file server to perform an update with the appropriate

configuration file and updated software, preferably when the requesting component is experiencing a low work load or is idle

Figure 5 illustrates a block flow diagram for exchanging or replacing a server within the web support system described above. In the step **501**, the malfunctioning component is remove from the pre-configured wire harness and replaced with a new component. Once the replacement device is installed and connected to the pre-configured wire harness in the step **501**, then in the step **503** the replacement device is programmed with a configuration file from the file server. Generally, the configuration file will program the new device with the same functional personality as the device replaced in the step **501**. It is often the case, however, that the replacement device performs a new or modified function within the system and, therefore, the configuration file corresponding functionality of the replaced device is not suitable or compatible for the new device. In this case, and other cases where a new configuration file is required, a new configuration file is down loaded to the file server in the step **502**, and prior to the step **503** of programing the new device. Preferably, the new configuration file, corresponding to the modified personality, is down-loaded to the file server in the step **502** from a remote location as previously described above.

After the new server is programed with the appropriate configuration file in the step **503**, then in the step **504** a system check is performed to ensure that the new device is operating correctly. If it is determine that the replacement device is operating correctly in the step **505**, then in the step **506** the device is periodically updated with a configuration file(s) and software as previously described. If, however, it is determined that the replacement device is not operating correctly in the step **505**, then the steps **501-505** are repeated as necessary.

Because each server component within a system is typically provided in duplicate, a malfunction of a single server device will not cause a catastrophic system failure. However, a web site operating with a only a single critical server runs a significant chance of a catastrophic systems failure. Figure 5 outlines a method for replacing a defective server device when a replacement server device is available. However, there are circumstances when a spare or a replacement server is not available. To reduce the risk of a catastrophic system failure, it is useful to have a method and mechanism for replacing a critical malfunctioning servers with a "non-critical" or "less critical servers" which are available in duplicate within the system. In this way the web system is capable of maximizing available system resources to support critical system functions. Preferable, such a method allows for the replacement of a defective web server within the system with a functioning application server within the system.

The Figure 6 illustrates schematic of a three-tier web-support system architecture with a wire harness configured with a switching means for exchanging the connectivities of server devices within the system **600**. The system **600** has web interface tier **650** with servers **605-607**. The web interface tier **650** is connected to the web **601** at the systems level through a bus **627** with an in-line router device or a firewall device **604**. The system architecture preferably is a multi-path data transmission architecture described in detail above and illustrated in the Figure 3, but may also be a single path data transmission architecture. The system **600** has a load balancer **602** which coordinates data transmissions and directs traffic between customers accessing web pages or HTML files stored on the units **605-607**.

Still referring to Figure 6, the system **600** also has an application tier **651** with the server units **609-611**. The data base tier **652** has at least one data base device **613** which

provides the data storage and data management required for the system. The units **605-607**, in the web interface tier **650**, and the units **609-611**, in the application tier **651**, are in duplicate (not shown) and are connectably interchangeable with one another as hardware devices. Further, each of the units **605-611** are capable of being programmed to operate as an application server or as a web server. For example, the unit **610** can be physically interchanged with the unit **606** by disconnecting the two units from the wire harness and reconnecting the unit **606** to the original connectivities of the unit **610** and connecting the unit **610** to the original connectivities of the unit **606**. The unit **606** can then be programmed to operated as a application server and the unit **610** can be programed to operate as a web server.

Still referring to Figure 6, the wire harness **612** has a switching meaning, indicated by the stitches **613** and **615**, for the changing the connectivities of at least one of the server units with the connectivities of another server unit; in this case switching unit **606** for unit **610**. Typically, the web server units **605-607** are more critical to the operations of the system **600** than are the applications servers **609-611**. Therefore, it is preferable that the wire harness **612** is configured to switch out at least one application server from the application tier **651** to the web interface tier **650**. It is clear, however, that the wire harness may be configured to "switch out" any of the units **605-611** with any other of the units **609-611** in order to maintain redundancy of the system components that are considered to be most critical to the operation of the system **600**.

Figure 7 illustrates web support system architecture **700** with a central control unit **710** according to an alternative embodiment of the current invention. The web support system **700** has a load balancer **702**, a router **703**, web servers **704-705**, application servers **706-707**, a file server **708** and a data base device **709** for providing systems

functions previously described. Preferably, each of the web servers **704-705**, the application servers **706-707**, the file server **708** and the data base **709** are in communication with the central control unit **710**. The control unit **710** has data processing and data storage capabilities. The central control unit **710** is in communication with the components **704-709** by any suitable means including video cameras, temperature sensors, mechanical sensors and the like. The central control unit **710** servers two primary functions. Firstly, central control unit **710** tracks the physical environment of each of the system components **704-709**. When the physical environment of a component compromises the performance of that component, the control unit **710** generates a warning or an alert to warn an operator that the component is in jeopardy of a failure. Secondly, the control unit **710** stores tracking data collected while monitoring the physical environments of each of the components **704-709**. In the event that a failure does occur, tracking data can be used to determine the cause of the failure and to implement procedures to prevent the reoccurrence of such a failure.

The present invention has been described in terms of specific embodiments incorporating details to facilitate the understanding of the principles of construction and operation of the invention. Such reference herein to specific embodiments and details thereof is not intended to limit the scope of the claims appended hereto. It will be apparent to those skilled in the art that modifications can be made in the embodiment chosen for illustration without departing from the spirit and scope of the invention. Specifically, it will be apparent to one of ordinary skill in the art that the device of the present invention could be implemented in several different ways and the architecture, system and method disclosed above are only illustrative of preferred embodiments of the invention.